Valuing Water Quality in Midwestern Lake Ecosystems

Kevin Egan, Joseph Herriges, and Catherine Kling
Dept. of Economics, Center for Agricultural and Rural Development
John Downing
Dept. of Ecology, Evolution and Organismal Biology

IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

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Overview

As increased attention is focused on the issue of water quality in the state of Iowa, policy makers must grapple with the pressures of balancing federal water quality requirements, tight conservation budgets, and citizen concern for environmental preservation and restoration of Iowa's water resources. Efforts to improve water quality typically entail significant costs, either in the form of state resources to fund cleanup efforts or private costs associated with altering land uses, farming practices, municipal treatment facility expansions, or other investments.

To make good policy decisions regarding water quality, it is important to understand not only the physical processes that affect water quality, but also the degree to which citizens value improvements in water quality and are willing to make tradeoffs to enjoy improved quality in Iowa's lakes. Since water quality improvements may be costly, it is necessary to know how much benefit people obtain from these improvements if society is to answer the question of whether it is "worth it" to undertake these projects. In many cases the question will be one of degree: that is, how much improvement in water quality should we strive for? What amount of improvement in water quality is simply too expensive and would thereby require foregoing other public investments that are more valuable to the citizenry?

To provide this information, researchers from Iowa State University have initiated an ambitious, multi-year study effort termed "The Iowa Lakes Valuation Project."

Study Sites

Iowa

Iowa State University Lake Study Sites
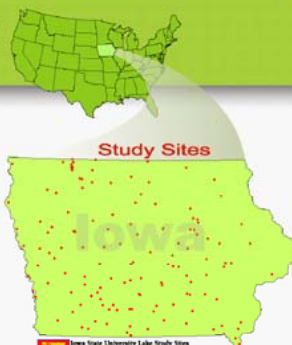
The Iowa Lakes Valuation Project is an economic study of the use and value Iowan's place on water quality in Iowa lakes. Data for this study will be collected over a four-year period through the implementation of annual mail surveys to a random sample of Iowa residents. The data gathered will include:
- actual trips to Iowa's 130 principle recreation lakes for the years 2001-2006;
- water quality evaluations used to measure willingness-to-pay for quality improvements;
- knowledge and perceptions regarding lake quality; and
- socio-demographic data.

The value of water quality improvements in Iowa lakes is measured using the economic value concept of maximum willingness-to-pay. The maximum amount that an individual is willing to pay for an environmental good measures the value they place on that good in that it represents the value of other goods and services they are willing to forgo to acquire or preserve the environmental resource.

The Iowa Lakes Valuation Project is a collaborative study involving economists and ecologists from the Iowa State University Department of Economics, Center for Agricultural and Rural Development, and Department of Evolutionary Ecology and Organismal Biology. Dr. John Downing and other members of the ISU Limnology Laboratory have a complementary five-year project to provide the Iowa Department of Natural Resources with a lake database that will include water chemistry, biological analysis, and watershed GIS data for 130 of Iowa's principle recreation lakes.
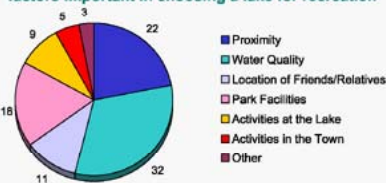
EPA's STAR grant augments work begun with Iowa DNR funding and Iowa State University Center for Agricultural and Rural Development support. The funding for the first year of the survey was provided by the Iowa Department of Natural Resources. The STAR grant from EPA provided the necessary funding to continue the survey for the full four years, thereby allowing the collection of this unique multi-year data set and interdisciplinary study.

First Year Study

First of four mail surveys

8,000 Iowa residents selected at random

Survey collected
- trip data for 132 lakes
  2001 and 2002 actual trips
  2003 anticipated trips
- attitudes regarding lake quality
- socio-demographic data

62.1% response rate
(90% coverage including telephone follow-ups)

Iowans report a high usage of lakes in the state of Iowa. Approximately 62 percent of Iowa households visited one of the 130 lakes listed in the survey and the average number of trips per year was just over eight in 2002.
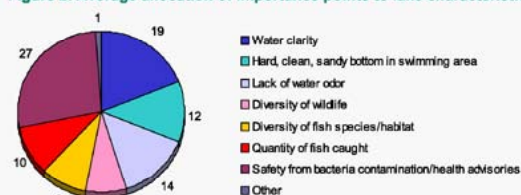
Water quality is more important than either proximity or local park facilities in determining where households recreate. Figure 1 shows the results of a question that asked respondents to allocate 100 importance points to a number of factors they might consider when choosing a lake for recreation. The average point allocation is shown. Respondents indicated that water quality was the most important factor they consider when choosing a lake for recreation, with proximity of the lake and park facilities also being relatively important. In contrast, activities near the lake or town are not particularly important in their choice of a lake site.

Figure 1: Average allocation of importance points to factors important in choosing a lake for recreation

- Proximity — 22
- Water Quality — 32
- Location of Friends/Relatives — 11
- Park Facilities — 18
- Activities at the Lake — 9
- Activities in the Town — 5
- Other — 3

Among water quality attributes, households view safety from bacterial contamination and water clarity as the most important, above the diversity or quantity of fish caught or the diversity of wildlife. Figure 2 shows the results of a question that asked respondents to allocate 100 importance points to a number of lake characteristics that might be important to them. Again, the average point allocation is shown. Respondents indicated that safety from bacteria contamination was the most important lake characteristic, with water clarity also receiving a fairly large point allocation. The lack of odor and the presence of a hard, clean, sandy bottom in swimming areas are also important to some respondents.

Figure 2: Average allocation of importance points to lake characteristics

- Water clarity — 19
- Hard, clean, sandy bottom in swimming area — 12
- Lack of water odor — 14
- Diversity of wildlife — 8
- Diversity of fish species/habitat — 9
- Quantity of fish caught — 10
- Safety from bacteria contamination/health advisories — 27
- Other — 1

Econometric relationship between the lakes households choose to visit and water quality

| Variable	Qualitative Sign	Variable	Qualitative Sign
Price (Travel Cost)	—	Secchi Depth	+
Log (Acres)	+	Chlorophyll	+
Ramp	+	Total Nitrogen	—
State Park	+	Total Phosphorus	—
Facilities	+	Inorganic SS	—
Wake	+	Volatile SS	0

Improving a few lakes to very high water quality levels is more valuable than water quality improvements that would remove all lakes from the impaired list

Average Valuation	Nine focus lakes[1] Improved to the physical water quality of the cleanest lake in the State	Sixty-five impaired lakes[2] improved to the median physical water quality of the non-impaired Lakes
per Iowa household	$16.74	$12.24
for all Iowa households	$19,300,000	$14,100,000

[1] The nine lakes were chosen based on recommendations by the Iowa Department of Natural Resources for possible candidates of a clean-up project.

[2] Listed on the EPA's impaired waters list; this scenario brings all the impaired lakes up to the median physical measures of the non-impaired lakes.

The value of lake water quality improvements varies notably based on current conditions of the lake and proximity to population centers
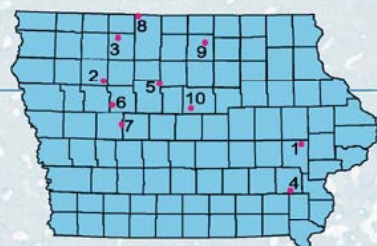
HIGHEST VALUED IMPROVEMENTS TO IMPAIRED LAKES[1]

Lake	ANNUAL valuation of the water quality improvement	Current Conditions — Secchi Depth (meters)	Total phosphorus (ug/l)	Total ANNUAL 2002 Trips	Iowans' average one-way travel distance
1. Coralville Lake	$11,800,000	0.8	204.2	510,000	130
2. Storm Lake	$1,200,000	0.5	89.2	267,000	185
3. Trumbull Lake	$1,100,000	0.1	452.6	20,000	195
4. Lake Darling	$1,000,000	0.3	226.0	67,000	143
5. Badger Creek Lake	$1,000,000	0.6	289.7	66,000	128
6. Black Hawk Lake	$900,000	0.9	193.0	139,000	162
7. Swan Lake	$600,000	0.2	327.3	145,000	152
8. Tuttle Lake	$500,000	0.2	310.5	37,000	203
9. Clear Lake	$400,000	0.8	61.9	454,000	151
10. Little Wall Lake	$400,000	0.5	81.0	53,000	124
Average across all of the 65 Impaired Lakes	$500,000	0.8	140	83,000	162

[1] Ranking of impaired lakes by the value of improving each individually to the median physical water quality values of the non-impaired lakes.

For additional information concerning the data, survey results, or statistical methods used herein, see the Center for Agricultural and Rural Development web site at **www.card.iastate.edu/environment.**

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